

B R E V I O R A

Museum of Comparative Zoology

CAMBRIDGE, MASS.

FEBRUARY 3, 1954

NUMBER 26

A PRELIMINARY LIST OF THE EARTHWORMS OF NORTHERN NEW JERSEY WITH NOTES

BY H. DAVIES

Dover, New Jersey

The literature of North American earthworms contains few references to New Jersey and no paper has appeared describing worms collected in that state. Moore (1895, p. 473) refers to three species found within 30 miles of Philadelphia (*Allurus tetraedrus*, *Bimastos palustris* and *Sparganophilus tamesis*), and Eaton (1942) mentions four lumbricids found at Alpine, N. J. and Edgewater, N. J. This paper is therefore presented as a contribution to the knowledge of the fauna of New Jersey.

Collections of earthworms were made above a line drawn east and west through Princeton, N. J. with a concentration in the area of Morristown and Dover. Notes are given on the living conditions of the various species where such are thought to add to our knowledge.

The term 'clitellate' is used in this note to describe worms with recognizable features of clitellar development regardless of the stage. Where the tubercula pubertatis only are present, 'aclitellate' is used, while worms having no indications of clitellum or tubercula are considered 'juveniles'.

Family LUMBRICIDAE

Genus ALLOLOBOPHORA Eisen 1874

ALLOLOBOPHORA ARNOLDI Gates 1952

Morristown, Mt. Kemble Road, in soil by stream; April 15, 1950,
2 clitellate specimens.

Andover, in rich loam in woods, April 12, 1953, 4 clitellate specimens, many juveniles.

Dover, in garden soil, April and May 1953, 3 clitellate specimens, many juveniles.

Morristown, James St., garden, May 19, 1953, 13 clitellate and 1 a clitellate specimens.

Mt. Freedom, in sandy ditch, May 19, 1953, 5 clitellate specimens.

Beatystown, in meadow, May 1953, 7 clitellate specimens.

Mt. Tabor, under stones in garden, June 8, 1953, 3 clitellate and 11 a clitellate (post sexual?) specimens.

This is the third record of a species which has hitherto been found in Massachusetts and New Hampshire. The specimens correspond to the diagnosis given by Gates except that the number of segments covers a slightly wider range as the data from 21 specimens show: 139(2), 140(1), 141(2), 143(1), 147(1), 153(1), 154(1), 160(1), 164(1), 174(1), 177(2), 181(1), 182(2), 183(1), 184(2), 187(1). In each of these the anal segments were normal in appearance; however amputation is prevalent in this species and some might prove to be amputees.

ALLOLOBOPHORA CALIGINOSA (Savigny) 1826

Dover, in garden soil (clay), June 8, 1953, 2 clitellate specimens.

Mt. Tabor, under stones in garden, June 10, 1953, 2 clitellate specimens.

Pompton Plains, in marshy meadow, June 1953, 3 clitellate specimens.

Paterson, in garden top soil, June 1953, 2 clitellate specimens.

These specimens are tentatively assigned to *caliginosa*, but do not conform to the description given by Cernovitov and Evans (1947, p. 13), as Table I illustrates. In every case a grey-brown pigment is present on the dorsal surface, the clitellum being a dull yellow.

Description of tubercula pubertatis:

Specimen No. 150a band-like, indentation at xxxii on upper side.

150b band-like, indentation at xxxii on upper side.

157a band-like, tripartite origin, on xxxi-xxxiii. Intersegmental lines distinct.

157b L. As 157a.

R. Band-like, slightly indented at 31/32 and 32/33.

161a }

161b }

162a }

162b }

Band-like, tripartite origin, on xxxi-xxxiii.

In each case the lateral portion of the tuberculum is translucent while the median portion is opaque and appears as a band.

Table I
External characteristics of *Allolobophora caliginosa*

Specimen No.	Locality	Number of segments	Clitellum	Tubercula pubertatis	Genital tumescences
150a	Dover	133	27- $\frac{1}{2}$ 35	31-33	30 32 33 34
150b	Dover	179	27- $\frac{1}{2}$ 35	$\frac{1}{2}$ 30-33	30 32 33 34
157a	Mt. Tabor	167	27- 34	31-33	30 32 33 34
157b	Mt. Tabor	156	27- 34	31-33	30 31 32 33 34
161a	Pompton Plains	161	27- 34	31-33	30 32 33 34
161b	Pompton Plains	156	27- 34	31-33	33 34(R)
162a	Paterson	159	27- 34	31-33	30 32 33
162b	Paterson (amputee)	130	27- 34	31-33	30 32 33 34

ALLOLOBOPHORA LIMICOLA Michaelsen 1890

Morristown, Glen Alpine Rd., in thick mud (pH 5.5) near branch of Primrose Brook, May 27, 1952, 25 clitellate specimens, April 26, 1953, 8 clitellate specimens, June 6, 1953, 5 clitellate specimens, many juveniles at each visit.

Dover, 2nd Street, marshy ground, June 8, 1953, 6 clitellate specimens.

Beatystown, wet meadow, June 10, 1953, 1 clitellate specimen.

The Morristown location is undisturbed marsh and remains wet throughout the year except during the winter freeze. Castings were noted under logs and debris but were not apparent on the surface. Both the Dover and the Beatystown locations are unimproved and are saturated throughout the year. On the June 6 visit to the Norristown location, worms were observed *in copula* approximately 4 inches underground.

This is the second record of this species in North America, Gates (1953, p. 518) having found it in the Arnold Arboretum in Boston. The specimens conform to the description given by Gates, the number of segments corresponding very closely and illustrating the narrow range of this species. Number of segments in 17 specimens: 104(2), 111(1), 112(1), 113(1), 114(3), 117(2), 121(2), 122(1), 123(2), 124(1), 129(1).

ALLOLOBOPHORA LONGA Ude 1885

- Dover, sandy soil in garden, Nov. 1951, 3 clitellate specimens.
Morristown, in garden soil (clay), May 10, 1953, 1 clitellate specimen.
Dover, in garden on 2nd St., June 8, 1953, 3 clitellate specimens.
Beatystown, damp soil in meadow, June 9, 1953, 1 clitellate specimen, 1 aclitellate (post sexual?) specimen.

Genus BIMASTOS Moore 1893

BIMASTOS PALUSTRIS Moore 1895

- Flanders, in wet moss in rocky stream near Route 31, Nov. 1951, 4 clitellate specimens.
Hardwick, in ditch in forest (running water), April 1952, 3 clitellate specimens.
Ironia, in wet moss by stream, Succasunna-Ironia Road, May 3, 1952, 1 clitellate specimen.
Swartswood, under moss on log by stream, May 29, 1952, 15 clitellate specimens in association with *E. tetradra*.
Mt. Freedom, in wet moss on marshy ground by stream, April 27, 1952, 7 clitellate and 1 juvenile specimens.
Shongum, Raynor Road, in very wet sandy loam by stream, March 29, 1953, 4 clitellate specimens.

This species seems to have an affinity for running water and is apparently more restricted in this respect than *Eiseniella tetradra* with which it is sometimes found. The above confirms Smith (1917, p. 169) who states that *B. palustris* is found in the wet earth of rivers and ponds and has been collected from New Jersey.

Spermatophores were noted on many specimens, the majority having one pair and two specimens having two pairs. One specimen from Swartswood has 53 segments, and one from Mt. Freedom 52 segments, and in each case there was no indication of amputation, the anal segment being normal in appearance. These numbers are smaller than the 80 to 100 given by Smith (1917).

Genus DENDROBAENA Eisen 1874

DENDROBAENA MAMMALIS (Savigny) 1826

- Morristown, Mt. Kemble Road, in moist soil by edge of stream, May 1, 1951, 4 clitellate specimens.

This is the first record for this continent of this species. It is considered to be endemic in the British Isles and has also been collected from a few localities in France. Its occurrence in North America is not unexpected since it has been intercepted on plant materials imported into this country (Gates, 1953, p. 530). The specimens conformed externally to the description given by Cernosvitov and Evans (1947, p. 20).

DENDROBAENA OCTAEDRA (Savigny) 1826

Morristown, Glen Alpine Road, in rotting wood, June 30, 1952,
17 clitellate specimens in association with *D. rubida*.

Little is known of the distribution of this species in North America although it has been collected in Massachusetts and Michigan in addition to Newfoundland and Greenland.

DENDROBAENA RUBIDA (Savigny) 1826

Dover, under rotting grass cuttings in garden, Nov. 10, 1951,
2 clitellate specimens.

Ironia, in damp moss by Succasunna-Ironia Road, May 3, 1952,
2 clitellate specimens.

Morristown, Glen Alpine Rd., in rotting wood, June 30, 1952, 8
clitellate specimens and 1 juvenile with *D. octaedra*.

The records of this worm in North America refer only to collections from New Hampshire, Massachusetts and Maine. However as the writer has also collected it in Michigan, it may be widely distributed.

DENDROBAENA SUBRUBICUNDA (Eisen) 1874

This species is recorded by Eaton (1942) as occurring at Alpine, N. J. It was not found in recent collecting.

Genus EISENIA Malm 1877

EISENIA FOETIDA (Savigny) 1826

This species is found plentifully in farm manure heaps in many North Jersey localities and is sold for bait in the area. It was found in every manure heap where a search was made and only one specimen was collected in any other habitat. However, the current farming practice of spreading manure daily instead of accumulating it, is probably reducing the numbers of *E. foetida* which cannot be said to be as "abundant" as Smith (1917, p. 165) implied.

EISENIA LÖNNBERGI Michaelsen 1894

Morristown, Mt. Kemble Road, in mud at bottom of stream,
April 1950, 2 clitellate specimens.

Stokes State Forest, Naponock Brook, in wet moss, April 12, 1952,
1 juvenile.

Ironia, under moss and in wet earth by stream, May 3, 1952,
2 clitellate and 4 juvenile specimens.

Shongum Lake, in wet soil by stream, May 1952, 1 clitellate and
4 juvenile specimens.

Dover, Millbrook Valley, in swampy ground, Aug. 1952, 5 clitel-
late and 4 juvenile specimens.

Great Swamp, Madison, in wet moss and debris by water (pH 6.0),
April 26, 1953, 2 juveniles.

In addition to the above, 4 clitellate and 9 juvenile specimens
were obtained from the Pennsylvania bank of the Delaware above
Montague, N. J. Some of these were completely submerged under
water in gravelly mud.

Table II
External characteristics of *Eisenia lönnbergi*

Condition	Number of segments	Clitellum	Tubercula pubertatis	Regener- ation	Remarks
aclitellate	77	—	26-28	56/57	
clitellate	62	24-30	26- $\frac{1}{4}$ 29	—	Amputee
clitellate	110	$\frac{1}{2}$ 23-30*	26-28	—	Amputee
aclitellate	129	—	26, 27, 28	—	
juvenile	76	—	—	—	
juvenile	116	—	—	—	
immature	48	—	—	7/8	Apparent head regenerate
clitellate	44	$\frac{1}{2}$ 24-30	26-28	—	Amputee
clitellate	79	?24-30*	26, 27, 28	—	Amputee
clitellate	51	24-30*	26- $\frac{1}{4}$ 29	—	Amputee
clitellate	142	?24-30*	26- $\frac{1}{4}$ 29	—	
juvenile	133	—	—	101/102	
juvenile	132	—	—	47/48	
juvenile	74	—	—	—	Amputee
juvenile	118	—	—	—	
juvenile	132	—	—	—	
juvenile	135	—	—	—	
juvenile	104	—	—	—	
clitellate	125	24-30*	26- $\frac{1}{4}$ 29	—	

*Clitellum feebly developed.

There are few references to this worm and little has been published regarding its habitat. It has been found in Georgia, Virginia, North Carolina, Connecticut and Massachusetts. Evidently it is widely distributed in northern New Jersey and is probably endemic. Its habitat appears to be restricted to very wet locations in or along the banks of rivers or streams.

The range in segment number of normal specimens from 125 to 142, extends the previous record of 138 segments (Smith 1917, p. 164). The incidence of amputation is very high in the specimens collected, whether this is due to predatism or to autotomy is not known, but none of the specimens autotomized during handling in collection or preservation.

EISENIA ROSEA (Savigny) 1826

Stokes State Forest, in soil, May 30, 1950, 2 clitellate specimens.
Dover, in clay soil in garden, Nov. 17, 1951, 1 clitellate specimen.
Morristown, in marshy soil, (pH approximately 5.5), June 30, 1952, 1 clitellate specimen.

Swartswood, in mud at edge of stream, May 29, 1952, 1 clitellate specimen.

Layton, in muddy ditch by road, April 3, 1953, 1 clitellate specimen.

Andover, woods near Lackawanna R.R. (Cutoff), in rich black loam, April 12, 1953, 2 clitellate specimens.

Table III
External characteristics of *Eisenia rosea*

Specimen No.	Number of segments	Clitellum	Tubercula pubertatis	Tumescences including <i>ab</i>	Tumescences including <i>cd</i>
44a	112	25-32	29- $\frac{1}{2}$ 31	26-31	12(L), 13(R)
44b	114	25-32	29- $\frac{1}{4}$ 31	26-31	11, 12(L), 12(R)
61	109	25-31	29- 30	26-31	11, 12
55	128	26-32	29- 31	26-32	12(R)
122	131	26-32	29- 31	25-32	None
120	130	$\frac{1}{2}$ 26-32	30- 31	12(L), 11, 12(R) 26-32	None

Further description of tubercula pubertatis:

No. 44a Tubercula bluntly elliptical from 28/29 to $\frac{1}{2}$ 31 without marginal incisions. Intersected by furrow 29/30 only.

- 44b Shape as 44a but extending to $\frac{1}{4}$ 31. Slight indication of intersegmental furrow 29/30 on L. side.
- 61 Tubercula elliptical, from 29/30 to 30/31 with incisions at 29/30 on both margins and distinct furrow across tubercula at 29/30.
- 55 Tubercula somewhat ill defined ellipse from 28/29 to 31/32 intersected by distinct furrows at 29/30 and 30/31.
- 122 Single tuberculum on 29 and elliptical mass from 29/30 to 31/32. Furrow 29/30 very distinct. Slight incision on median margin at 30/31 with trace of furrow.
- 120 Tubercula elliptical from 29/30 to 31/32 with incisions in both margins at 30/31. Indistinct furrow at 30/31.

The presence of tumescences in the clitellar region would appear to identify these specimens as var. *macedonica* Rosa 1893, which is said to be characterized "by the presence of small, mostly lightly coloured glandular papillae along the border of the clitellum" (Cernovitov and Evans 1947, p. 23). However, this variety is ill defined in comparison with the typical form and positive identification cannot be given.

Genus EISENIELLA Michaelsen 1900

EISENIELLA TETRAEDRA (Savigny) 1826 forma typica

Morristown, at roots of grass in stream, April 15, 1950, 1 clitellate specimen.

Stokes State Forest, in mud under stone in stream, June 10, 1951, 1 clitellate specimen. In wet moss, Naponock Brook, April 12, 1952, 3 clitellate specimens.

Swartswood, under moss in stream, May 29, 1952, 2 clitellate specimens in association with *B. palustris*.

Dover, in marsh near Orchard St. Cemetery, June 20, 1952, 18 clitellate specimens, many juveniles.

Great Swamp, Madison, under wet leaves, May 1952, 8 clitellate specimens.

Buttzeville, under wet leaves at edge of Pequest River, April 16, 1952, 8 clitellate and 3 juvenile specimens.

Morristown, Glen Alpine Road, in wet gravel at brook, March and April 1953, 10 clitellate specimens.

One specimen collected at Morristown has the male pores on segment ix with the clitellum correspondingly forward, apparently due to hypomeric regeneration.

On many specimens, setae *ab* of segment xxii are genital, occasionally on prominent lightly colored tumescences.

Genus *LUMBRICUS* Linnaeus 1758

LUMBRICUS RUBELLUS Hoffmeister 1843

Stokes State Forest, Big Flat Brook, under leaves, May 30, 1950,
1 clitellate specimen.

LUMBRICUS TERRESTRIS Linnaeus 1758

Throughout that part of New Jersey with which we are concerned, this worm is very common in lawns and gardens. It is also found in meadows, particularly where the ground is marshy, and in ditches. It is much in demand by local fishermen and is sold for bait in many places.

Genus *OCTOLASIUM* Oerley 1885

OCTOLASIUM LACTEUM (Oerley) 1881

Buttzeville, under rotting leaves at edge of Pequest River, Aug.
16, 1952, 1 clitellate specimen.

One clitellate specimen was also collected in May 1950 from gravelly mud under water level from the Pennsylvania bank of the Delaware above Montague, N. J. Both specimens have tumescences on *ab* of xxii (one specimen also on xxi, right).

Family *GLOSSOSCOLECIDAE*

Subfamily *SPARGANOPHILINAE*

Genus *SPARGANOPHILUS* Benham 1892

SPARGANOPHILUS EISENI Smith 1895

Morristown, Glen Alpine Rd., in mud under water (pH 5.5) in bay of Primrose Brook, May 27, 1952, 28 clitellate specimens, many juveniles. June 6, 1953, 2 clitellate specimens, many juveniles.

Dover, Second St., in mud at water level of pond (pH of water approximately 8.0), July 16, 1952, 10 clitellate specimens, many juveniles. In stream feeding pond, June 8, 1953, 2 clitellate specimens, 3 juveniles.

Castings were produced by this species at both localities. Early in

April, castings were formed on the surface of the mud, each casting being approximately $\frac{1}{2}$ in. in diameter and $\frac{1}{2}$ in. high and generally conical in shape. As time passed, the number of such castings became greatly increased until in four weeks the whole area was covered. In early May at the Morristown location, castings were observed under water. These increased in size progressively and became supported by grasses growing out of them, becoming eventually a beehive shape with a height of 6 to 8 inches and projecting above water level. As warmer weather arrived, the water level receded, leaving the casting exposed. Examination of these castings revealed numbers of juveniles, adult specimens being obtained only by digging in 4 to 6 inches of mud.

In many cases, both of clitellate and juvenile worms and particularly at the Morristown location, the last 10 to 30 segments were brownish in color, probably indicative of parasitic bodies accumulating in the coelom. Specimens collected at Dover were noticeably shorter than those at Morristown where one specimen possessed 258 segments (165 to 225 according to Olson 1940, p. 9). Posterior regeneration was noted in six specimens.

Family MEGASCOLECIDAE

Genus *PHERETIMA* Kinberg 1867

PHERETIMA AGRESTIS (Goto & Hatai) 1899

Maplewood, rotting leaf pile in private garden, June 1953, 2 clitellate specimens.

PHERETIMA LEVIS (Goto & Hatai) 1899

Maplewood, rotting leaf pile in private garden, June 1953, 3 clitellate specimens.

PHERETIMA sp.

Maplewood, rotting leaf pile in private garden, June 1953, 2 a clitellate and 1 clitellate specimens.

The last three specimens were athecal as well as anarsenosomphic and could not be referred to either of the two above-mentioned species.

All the pheretimas were found in a garden which contains many oriental shrubs. The species are known to have been present for at least three years and may possibly have been imported directly from the orient.

The leaf pile is under a large conifer and the protection thus afforded, together with the heat generated by the pile may preclude severe winter freezing.

The writer is indebted to Dr. G. E. Gates for the identification of the specimens of *Pheretima* sp.

DISCUSSION

Earthworms of twenty species have now been recorded from northern New Jersey and of these fifteen are recorded from the state for the first time. As might have been anticipated, the majority of species are widely distributed peregrine lumbricids of Eurasian origin. *Dendrobaena mammalis* was found for the first time outside of Europe where it is endemic in the British Isles. This species has been intercepted on plant materials imported into North America (Gates 1953, p. 530), and its appearance, therefore, might have been anticipated.

Bimastos palustris and *Eisenia lönnbergi* are evidently endemic, and relatively common in their restricted habitat along the banks of streams. Neither of these is listed by Olson (1940) as occurring in New York State and this may imply that northern New Jersey, corresponding roughly to the extent of the ice cap in glacial times, is the northern limit of their general distribution. The glossoscolecoid *Sparganophilus eiseni* is presumed to be endemic, although its original source may well be south of New Jersey. That each of the endemic species has a limnic habitat may be of significance as the lack of competition and the ease of colonization thus afforded may have enabled these species to quickly repopulate the barren areas left by the retreating ice cap.

Allolobophora limicola, found in three locations, has just recently been recorded from Boston (Gates, 1953), where it was thought to have been introduced from Europe. As the three New Jersey localities are respectively 10 and 16 miles apart, possibility of a single introduction seems unlikely. *Allolobophora arnoldi* Gates, recently described and only known heretofore from two New England states, was found to be relatively common. It is tentatively considered to be of European origin. The species of *Pheretima* were not expected as no attempt was made to search in ornamental gardens or greenhouses. They are probably of East Asian origin and may have been imported directly with exotic shrubs.

Of the anticipated species, *Bimastos tenuis*, *Allolobophora chlorotica*, and *Dendrobaena subrubicunda* were not found in recent collections. *A. chlorotica* was probably overlooked as it has been found in Rockland County, New York, within a few miles of the New Jersey border. Altogether, collections were made in 55 locations, some of which were found to be heavily populated. Five species were taken from a Dover garden and six species from a pond and adjacent swamp near Morris-

town. *Allolobophora arnoldi*, *A. caliginosa*, *A. limicola* and *A. longa* were found together in one piece of marshy ground in a garden.

In northwestern New Jersey, comprising Warren and Sussex counties, the terrain is characterized by dense woodland rising to 1500-1800 feet. The soil of these woods is largely glacial drift with numerous rocky ledges and outcrops. Searching for earthworms in such localities proved to be most unproductive, possibly due to the fact that the soil drains and dries out very rapidly. However, *Bimastos palustris* and *Eiseniella tetraedra* were found in woodland ditches and streams at isolated locations where the top soil was entirely without worms. Similarly, the top soil of wooded areas in Morris County was found to be largely without worms except where the ground was damp as often denoted by the presence of skunk cabbage (*Symplocarpus foetidus*).

SUMMARY

Twenty species of earthworms have now been recorded from northern New Jersey, including sixteen lumbricids, one glossoscolecid and three megascoleids. Thirteen of these are recorded for the first time from this state, *Dendrobaena mammalis* being reported for the first time outside of Europe. *Bimastos palustris* and *Eisenia lönnbergi* are considered to be endemic and are widely distributed in the northern part of the state. *Allolobophora limicola* was found for the second time outside Europe and in three localities. Three species of *Pheretima* were present in a garden.

REFERENCES

CERNOSVITOV, L. and A. C. EVANS

1947. Lumbricidae. No. 6 in Synopses of British Fauna. London, Linnean Society, 1-36.

EATON, T. H., JR.

1942. Earthworms from the North Eastern United States. Jour. Washington Acad. Sci., **32**, No. 8: 242-249.

GATES, G. E.

1952. New species of earthworms from the Arnold Arboretum, Boston. Breviora, **9**: 1-3.
1953. On the earthworms of the Arnold Arboretum, Boston. Bull. Mus. Comp. Zool. Harvard, **107**, No. 10: 497-534.

MOORE, H. F.

1895. On the structure of *Bimastos palustris*, a new oligochaete. Jour. Morph., **10**: 473-496.

OLSON, H. W.

1940. Earthworms of New York State. Amer. Mus. Nov., No. **1090**: 1-9.

SMITH, F.

1917. North American earthworms of the family Lumbricidae. Proc. U. S. Nat. Mus., **52**: 157-182.